Beckman Industrial™

An Affiliate of Emerson Electric Co.

Circuitmate™

DM10, DM15B & DM20L Digital Multimeters

Operator's Manual

Location :-

ID 0330

01

Circuitmate™
Models
DM10, DM15B & DM20L

Operator's Manual

Beckman Industrial Corporation
Instrumentation Products Division
An Affiliate of Emerson Electric Co.
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WARRANTY

90-Day Limited Warranty

CircuitMate™ Digital Multimeters are warranted in entirety against defects of material or workmanship which develop for any reason whatsoever, except abuse, within a period of 90 days following the date of purchase of the multimeter by the original purchaser. This warranty is extended by Beckman Industrial Corporation only to the original purchaser or original user of the multimeter who must as a CONDITION PRECEDENT TO WARRANTY COVERAGE AND PERFORMANCE THEREUNDER BY BECKMAN INDUSTRIAL CORPORATION complete and return the Warranty Registration Card received on purchase of the multimeter.

In the event a defect develops during the warranty period, Beckman Industrial Corporation at their election will repair or replace the multimeter with a new or reconditioned model of equivalent quality. In order to obtain performance of any obligation of Beckman Industrial Corporation under the warranty, the original purchaser or original user must return the defective multimeter postage prepaid along with a handling charge of $3.00 to:

Beckman Industrial Corporation
Instrumentation Products Division
An Affiliate of Emerson Electric Co.
550 S. Harbor Blvd.
La Habra, CA 90631

In the event of replacement with a new or reconditioned model, the replacement unit will continue the warranty period of the original multimeter. The turnaround time for replacement units at the Service Center is typically only two (2) working days.

ANY IMPLIED WARRANTIES ARISING OUT OF THE SALE OF A CIRCUITMATE MULTIMETER, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED IN DURATION TO THE ABOVE STATED 90-DAY PERIOD. BECKMAN INDUSTRIAL CORPORATION SHALL NOT BE LIABLE FOR LOSS OF USE OF THE MULTIMETER OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES, EXPENSES OR ECONOMIC LOSS OR FOR ANY CLAIM OR CLAIMS FOR SUCH DAMAGE, EXPENSES OR ECONOMIC LOSS.

Some states do not allow limitations on how long implied warranties last or the exclusion or limitation of incidental or consequential damages so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

Beckman Industrial Corporation, San Diego, CA

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WARNINGS AND PRECAUTIONS

Please read section 2.1 and 2.2, WARNINGS AND PRECAUTIONS

Even low-level voltages and currents can potentially cause serious injury or even death from electrical shock. Please do not use this or any piece of test equipment without proper training.

SECTION ONE:
INTRODUCTION

1.1 Unpacking and Inspection

Upon removing your new Digital Multimeter (DMM) from it's packing, you should have the following items:

1. Digital Multimeter
2. Test Lead Set (1 black, 1 red)
3. 9-Volt Battery (in meter)
4. Warranty Card
5. Operators Manual
6. Two fuses (One spare, one in meter)

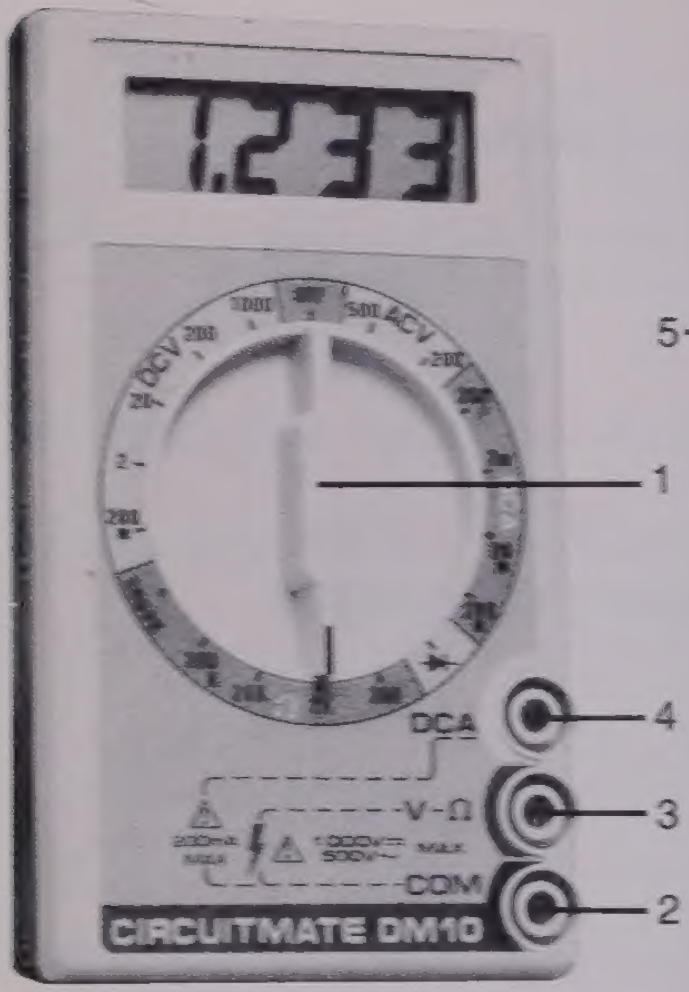
Note: The proper fuse for the DM10 is 0.8A, 250 volt. The fuse for the DM15B and the DM20L is 2.0A, 250 volt.

If any of the above items are missing or are received in a damaged condition, please contact the distributor from whom you purchased the unit.

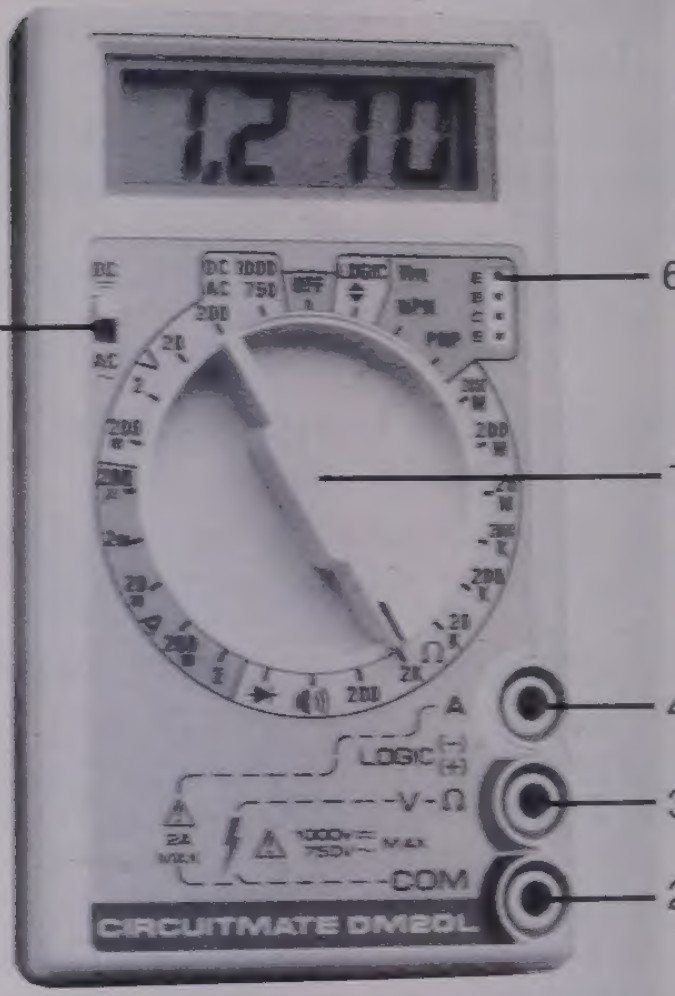
1.2 Familiarization (See photos next page)

1. FUNCTION/RANGE SWITCH: Selects the Function and Range desired.
2. COM INPUT TERMINAL: Ground input connector.
3. V-Ω INPUT TERMINAL: Positive input connector for volts and ohms.
4. A INPUT TERMINAL: Positive input connector for amps.
5. AC/DC SELECTOR: Selects DC or AC measurement mode.
6. TRANSISTOR TEST SOCKET (DM20L only): Used for transistor hFE measurements.

NOTE: RANGE OVERLOAD IS INDICATED BY A "1" OR "−1" IN THE DISPLAY WITH ALL OTHER DIGITS BLANKED. IN THIS CONDITION, THE USER MUST TAKE IMMEDIATE STEPS TO REMOVE THE CAUSE OF THE OVERLOAD CONDITION FROM THE METER.



DM10



DM15B and DM20L

Familiarization

1. FUNCTION/RANGE SWITCH
2. COM INPUT TERMINAL
3. V-Ω INPUT TERMINAL
4. A INPUT TERMINAL
5. AC/DC SELECTOR
6. TRANSISTOR TEST SOCKET

SECTION TWO:
OPERATION

⚠ Means PLEASE REFER TO OPERATING INSTRUCTIONS to insure operator safety.

2.1 Warnings

Since injury or death can occur even with low voltages, exercise extreme caution when:

Measuring voltage above 20 volts.
Measuring AC mains with inductive loads.
Measuring AC mains during electrical storms.
Measuring constant-voltage transformers with open circuit voltage greater than 1000 volts AC.
Measuring current with open circuit voltage greater than 250 volts.

Measuring voltage which exceeds the limits of the meter may damage the meter and expose the operator to a shock hazard.

Inspect the test leads and all insulation for damage before each use. DO NOT USE IF DAMAGED.

To avoid shock hazard, do not touch probe tips or the circuit under test while power is applied.

2.2 Safety Precautions

1. Exceeding the maximum overload limits can damage the multimeter.
2. When making current measurements, make sure that the multimeter is connected in SERIES with the voltage source and the circuit load. NEVER connect the meter in parallel with the voltage source when measuring current.
3. Use only mild detergent and warm water to clean the meter. Do not use aromatic hydrocarbons or chlorinated solvents.

2.3 MEASUREMENT SET-UP: Use the following steps before taking any measurement with the meter:

1. Turn off power to the device under test and discharge all capacitors.
2. Connect the red and black test leads to the appropriate terminals on the meter (black to COM, red to V-Ω for volts or ohms, or to A for amps).
3. Connect the test leads to the device under test and turn on power.
4. After completing the measurement, turn off power to the device under test and discharge all capacitors, then disconnect the test leads.

2.4 Voltage Measurements

1. Complete steps 1-4 in Section (2.3) above. Select either AC or DC mode.
2. Set the range switch to the desired voltage range and note the reading in the display. NOTE: If the magnitude of the voltage is not known, start with the highest range and reduce the setting until a satisfactory reading is obtained.

2.5 Current Measurements

1. Complete steps 1-4 in Section (2.3) above. Select either AC or DC mode.
2. Set the range switch to the desired current range, and note the reading in the display. NOTE: If the magnitude of the current is not known, start with the highest range and reduce the setting until a satisfactory reading is obtained.

2.6 Resistance Measurements

1. Complete steps 1-4 in Section (2.3) above.
2. Set the range switch to the desired ohms range and note the result in the display. NOTE: If the magnitude of the resistance is unknown, start with the highest range and decrease the setting until satisfactory resolution is obtained.

ATTENTION DM20L USERS: The 200MΩ and 2000MΩ ranges have a fixed 10-count offset in the reading. When the test leads are shorted together in these ranges, the meter will display 01.0 in the 200MΩ range and 010 in the 2000MΩ range. This residual reading must be subtracted from the reading obtained in step 2 when these ranges are used, in order to obtain the actual resistance value. For example, when measuring 110MΩ on the 200MΩ range, the display will read 111.0, from which the 1.0 residual is subtracted to obtain the actual resistance of 110MΩ.

BEEPER NOTE (DM15B and DM20L only): In the Continuity positions the meter will beep when the resistance is below approximately 100 ohms.

2.7 Diode and Transistor Tests

2.7.1 Diode Tests

1. Complete steps 1-4 in Section (2.3) above.
2. Set the range switch to the diode position ( ), and connect the test leads to the diode to be checked (red to anode and black to cathode). If the diode is shunted by a resistor of 1000 ohms or less, it must be removed from the circuit before taking the measurement.

Read the forward voltage drop of the diode in the digital display. A typical reading for a good silicon diode is around 700 mV, while a germanium type will indicate approximately 200 mV. A "1" (overrange) indicates an open diode, while a very low reading indicates a shorted diode.
Reverse the test lead connections to the diode to perform a reverse-leakage test of the diode. A "1" (overrange) indicates a good diode while a "000" or other low reading indicates a diode with high reverse leakage current or that is shorted.

7.2 Transistor Tests

ipolar transistor junctions may be tested in the manner described in (2.7.1) as iode junctions formed by the emitter-base and base-collector junctions. Meas-rement should also be made between the emitter and collector to determine if a nort is present.

8 Transistor hFE Measurements (DM20L only)

Transistor must be out of circuit. Set the range switch to the hFE position, either NPN or PNP.
Plug the emitter, base and collector leads of the transistor into the appropriate holes in the transistor test socket. Read the hFE (beta, or DC current gain) in the display.

.9 Logic Measurements (DM20L only)

Connect the red and black leads to the V-Ω (logic +) and the A (logic −) inputs of the meter. Set the range switch to the logic position (◆).
Connect the black probe to the common buss of the logic circuit to be tested. Connect the red probe to the point to be tested. On a TTL logic 1 the logic "high" indicator will appear. On a TTL logic 0 the logic "low" indicator will appear and the beeper will sound.

ECTION THREE:
PERATOR MAINTENANCE

.1 Troubleshooting

there appears to be a malfunction during the operation of the meter, the follow-ng steps should be performed in order to isolate the cause of the problem:
Check the battery.
Review the operating instructions for possible mistakes in operating procedure.

3. Inspect and test the Test Probes for a broken or intermittent connection.
4. Inspect and test the fuse. If it is necessary to replace the fuse, be sure to install one of the proper current value.

3.2 Battery and Fuse Replacement

WARNING

To prevent electrical shock hazard, turn off the multimeter and any device or circuit under test and disconnect the test leads before removing the battery hatch or the rear cover.

3.2.1 Battery Replacement

1. Remove the battery cover by gently sliding it towards the bottom of the meter.
2. Remove and disconnect the old battery from the meter and replace with a new unit. Wind the excess lead length once around the battery clip. Install the battery and replace the battery cover.

CAUTION

Failure to turn off the multimeter before installing the battery could result in damage to the instrument and to the battery if the battery is connected incorrectly to the multimeter.

3.2.2 Fuse Replacement

1. Remove the battery cover by gently sliding it towards the bottom of the meter.
2. Remove the old fuse and replace with a new fuse of the proper rating. The DM10 requires a 0.8 amp, 250 volt fuse while the DM15B and DM20L both use fuses rated at 2.0 amps, 250 volts.

WARNING

To prevent fire, use a replacement fuse of the proper rating as shown in section (3.2.2) above.

3.4 Calibration

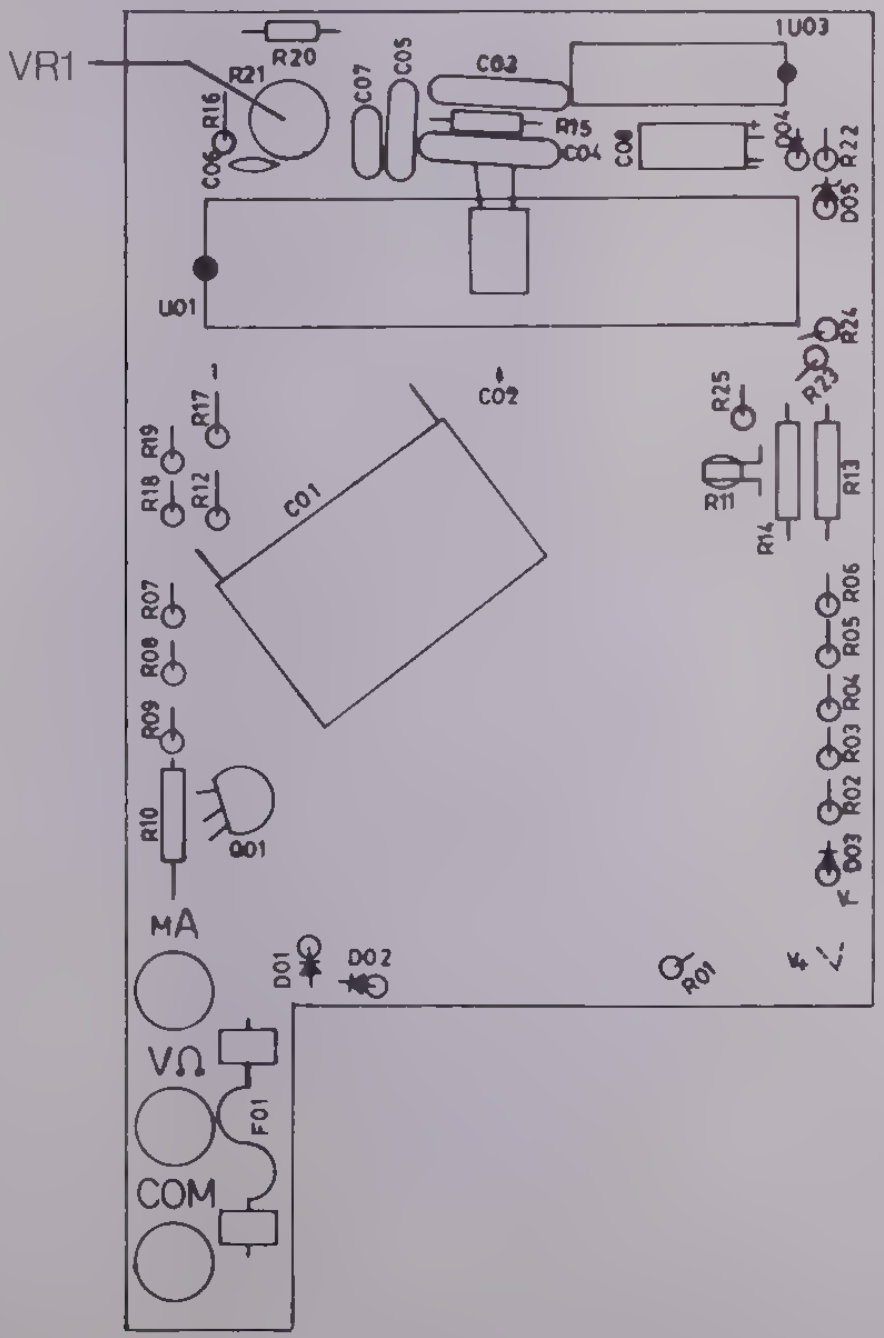
1. Perform calibration at 23 ± 2°C at a relative humidity of <70%. Allow the meter to stabilize at this temperature for at least 30 minutes prior to performing the calibration procedure.
2. Turn off the multimeter and any device under test and disconnect the test leads from the meter.
3. Remove the battery cover by gently sliding it towards the bottom of the meter. Remove the rear case by unscrewing the two screws that secure it to the front case and then gently prying the rear case away from the front case.

4. Select DC Volts and the 200mV range on the meter. Apply 190mV ± 0.02% to the V-Ω and the COM input connectors of the meter.
5 Adjust VR1 as shown to obtain a reading of 190 0 in the digital display

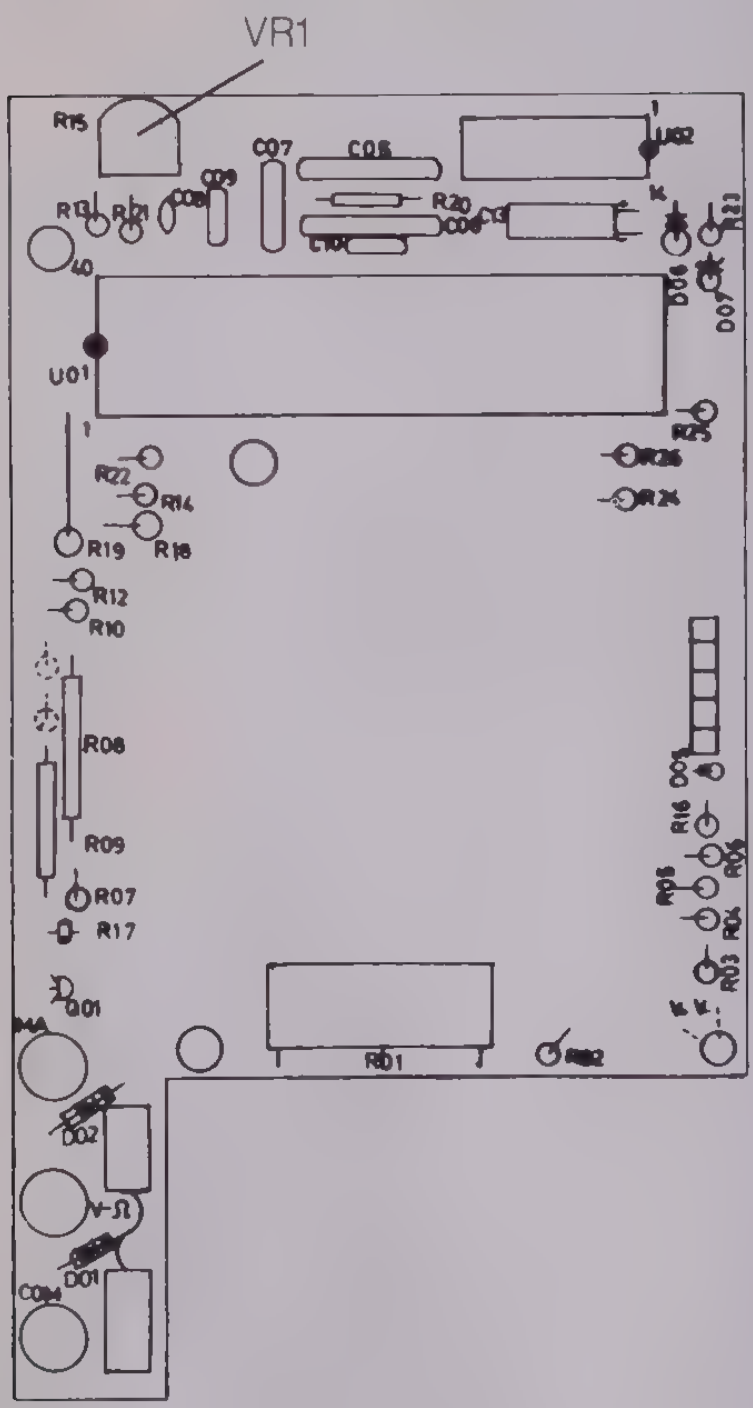
STEPS 6 AND 7 APPLY TO DM15B AND DM20L ONLY—

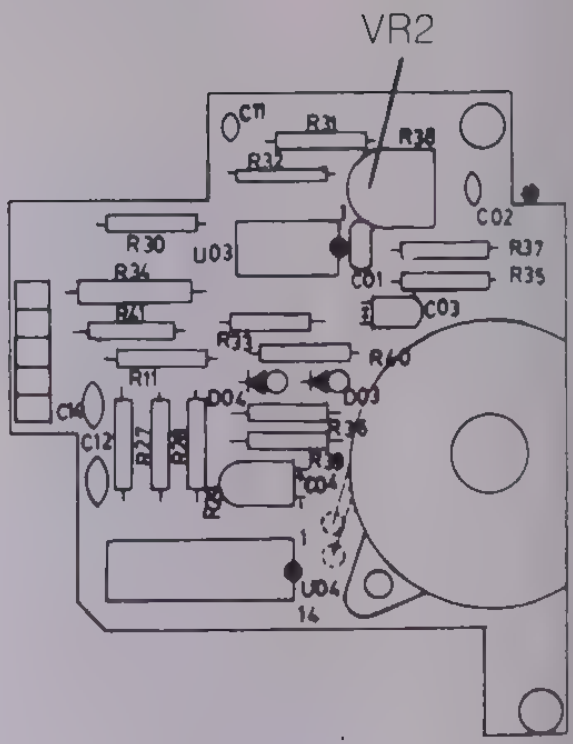
6 Select AC Volts and the 200mV range on the meter Apply 190.0mV ± 0.05%, 50 Hz to the V Ω and the COM input connectors of the meter.
7 Adjust VR2 as shown to obtain a reading of 190 0 + 2 digits in the digital display.
8 Disconnect the calibrator from the meter and reinstall the rear case and the battery cover.

DM10 Component Locations

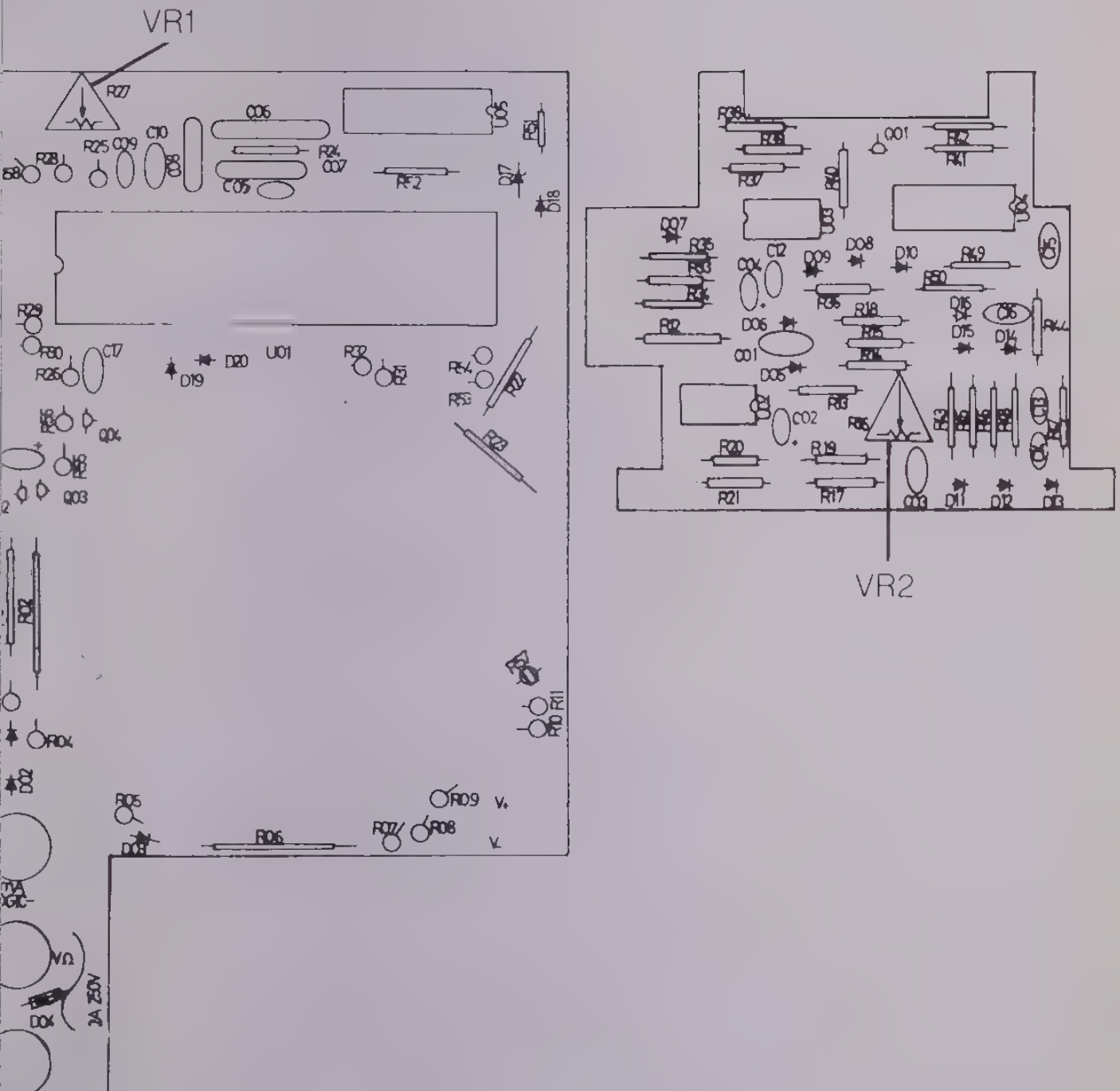


DM15B Component Locations





M20L Component Locations



SECTION FOUR: SERVICE

4.1 Warranty Information

In the United States and Canada, the limited warranty period is 90 days. For further warranty information, or for warranty information in Europe, please contact the following:

U.S. and CANADA

Beckman Industrial Corporation
550 S. Harbor Blvd.
La Habra, CA 90631
Tel: (213) 690-7255

EUROPE

Beckman Industrial, Ltd.
Queensway, Glenrothes, Fife
Scotland KY7-5PU, United Kingdom
Tel: 0592 753811

4.2 Warranty Repair

Any Circuitmate Series DMM claimed to be defective should be returned to Beckman Industrial Corp. with a $3.00 handling fee within the continental U.S. and $12.00 in Canada*. In Europe, please contact the above address for warranty repair information.

4.3 Nonwarranty Repair

Any out-of warranty Circuitmate DMM that is defective, but repairable, may be repaired by an authorized Service Center or by Beckman Industrial Corp. The repaired unit carries a one (1) month warranty. Inside the U.S. or in Canada, please contact Beckman Industrial or an authorized Service Center for the current out of warranty repair rates. In Europe, contact the above address for out-of-warranty repair information.

4.4 Shipping Instructions

DMM's returned for repair or for calibration should be accompanied by the following information or items. Company name, customers name, address, telephone number, proof of-purchase (warranty repairs), a brief description of the problem or the service requested, and the appropriate service charge.

Service charges should be remitted in the form of a check, a money order, or a purchase order made payable to Beckman Industrial Corp.

The DMM should be shipped with transportation charges prepaid to the following address:

INSTRUMENTATION PRODUCTS DIVISION
Beckman Industrial Corporation
550 S. Harbor Blvd.
La Habra, CA 90631
ATTN: Instrument Repair/Service

he DMM will be returned with the transportation charges paid by Beckman ndustrial Corp.

SECTION FIVE: SPECIFICATIONS

5.1 General Specifications

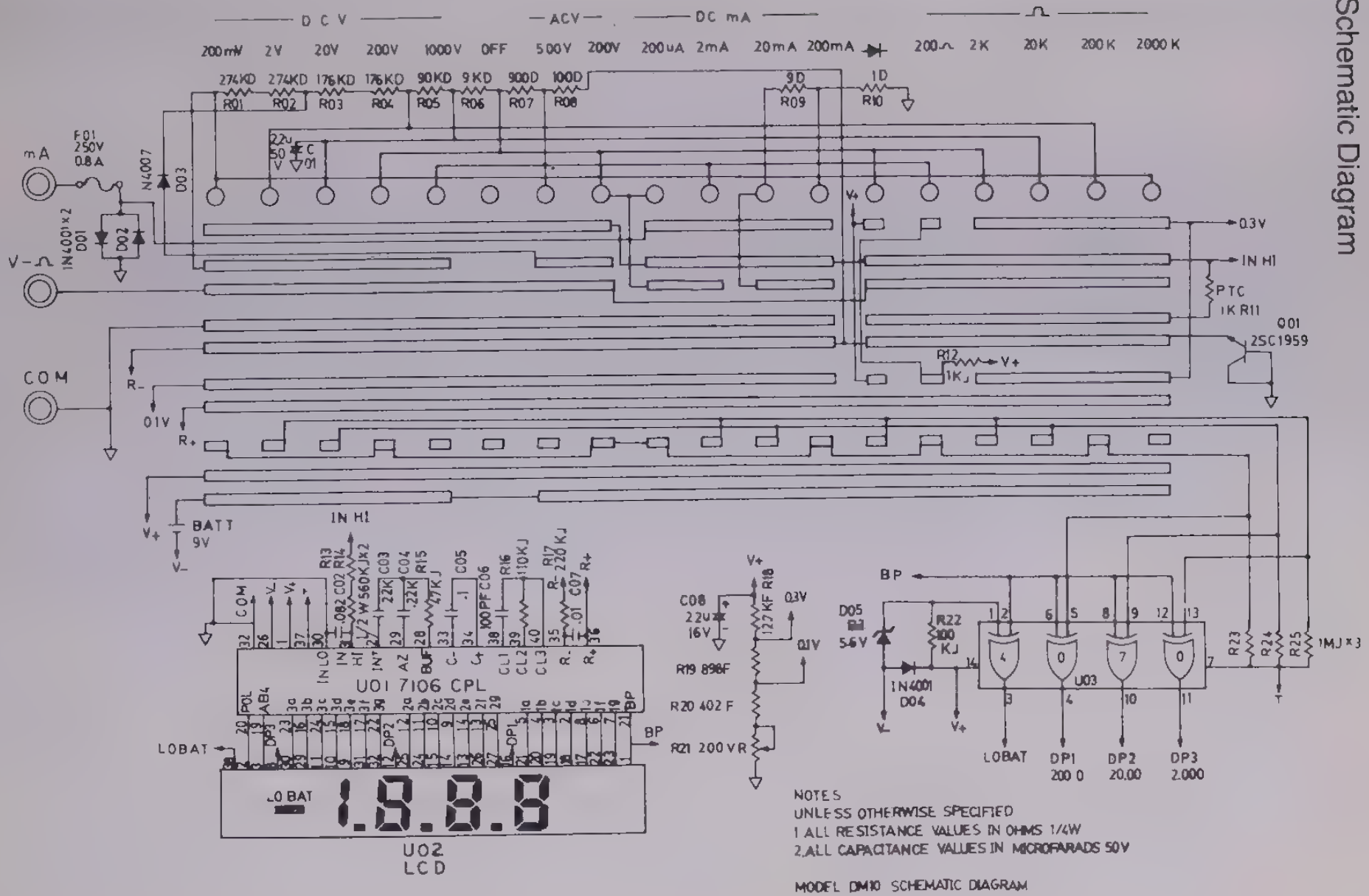
Display	• 3-1/2 digit Liquid Crystal Display (LCD) with a maximum reading of 1999
Polarity Indication	• Automatic, positive implied, negative indicated
Zero Adjustment	• Automatic.
Overrange Indication	• (1) or (−1) is displayed
Low Battery Indication	• (LO BAT) is displayed when the battery voltage drops below operating level
Display Update Rate	• 3 per second, nominal
Operating Temperature	• 0°C to 50°C, 0 to 70% Relative Humidity
Storage Temperature	• −20°C to 60°C, 0 to 80% R.H. with battery removed from meter
Accuracy	• Stated accuracy at 23°C ± 5°C, less than 75% R.H
Power	• Standard 9-volt transistor battery, NEDA 1604, JIS 006P, IEC 6F22
Battery Life (Typical)	• Alkaline / Carbon-Zinc
DM10	200 hours / 150 hours
DM15B	200 hours / 150 hours
DM20L	170 hours / 127 hours
Dimensions (H x W x D)	• 4.7 x 2.7 x 1.1 inches (11.9 x 6.9 x 2.8 cm)
Weight (including battery)	• 5.5 ounces (156 grams)
Accessories	• One pair test leads, one spare fuse, battery and Operators Manual

5.2 Electrical Specifications

DC Volts	DM10	DM15B	DM20L
Ranges			
200mV	X	X	X
2 Volt	X	X	X
20 Volt	X	X	X
200 Volt	X	X	X
1000 Volt	X	X	X
Accuracy		±0.8% RDG + 1 Digit	
Input			
Impedance	1MΩ	10MΩ	10MΩ
OL Protection			
200mV Range		350VAC/500VDC for 15 seconds	
Other Ranges		850VDC/1200VDC for 60 seconds	
Resolution	100μV	100μV	100μV
AC Volts			
Ranges			
200mV	—	X	X
2 Volt	—	X	X
20 Volt	—	X	X
200 Volt	X	X	X
750 Volt	X (500 V)	X	X
Accuracy		±1.2% RDG + 10 digit	
Input			
Impedance	450KΩ	10MΩ	10MΩ
OL Protection			
200mV Range		350VAC/500VDC for 15 seconds	
Other Ranges		850VDC/1200VDC for 60 seconds	
Resolution	100mV	100μV	100μV
DC Amps			
Ranges			
200μA	X	X	X
2 mA	X	X	X
20 mA	X	X	X
200 mA	X	X	X
2 A	—	X	X

	DM10	DM15B	DM20L
Accuracy		± 1.2% RDG + 1 digit	
Voltage Burden			
2 A Range		700mV max	700mV max
Other Ranges	350mV max	350mV max	350mV max
OL Protection	.8A, 250V fuse	2A, 250V fuse	2A, 250V fuse
Resolution	100nV	100nV	100nV
AC Amps			
Ranges			
200µA	–	X	X
2 mA	—	X	X
20 mA	—	X	X
200 mA	—	X	X
2 A	—	X	X
Accuracy			
2 A Range	—	±3% RDG ±4 digits	
Other Ranges	—	±1.8% RDG ±4 digits	
Voltage Burden			
2 A Range	—	700mV max	700mV max
Other Ranges	—	350mV max	350mV max
OL Protection	—	2A, 250V fuse	2A, 250V fuse
Resolution	—	100nV	100nV
Resistance			
Ranges			
200 ohm	X	X	X
2K ohm	X	X	X
20K ohm	X	X	X
200K ohm	X	X	X
2Meg ohm	X	X	X
20Meg ohm	—	X	X
200Meg ohm	—	-	X
2000Meg ohm	–	—	X

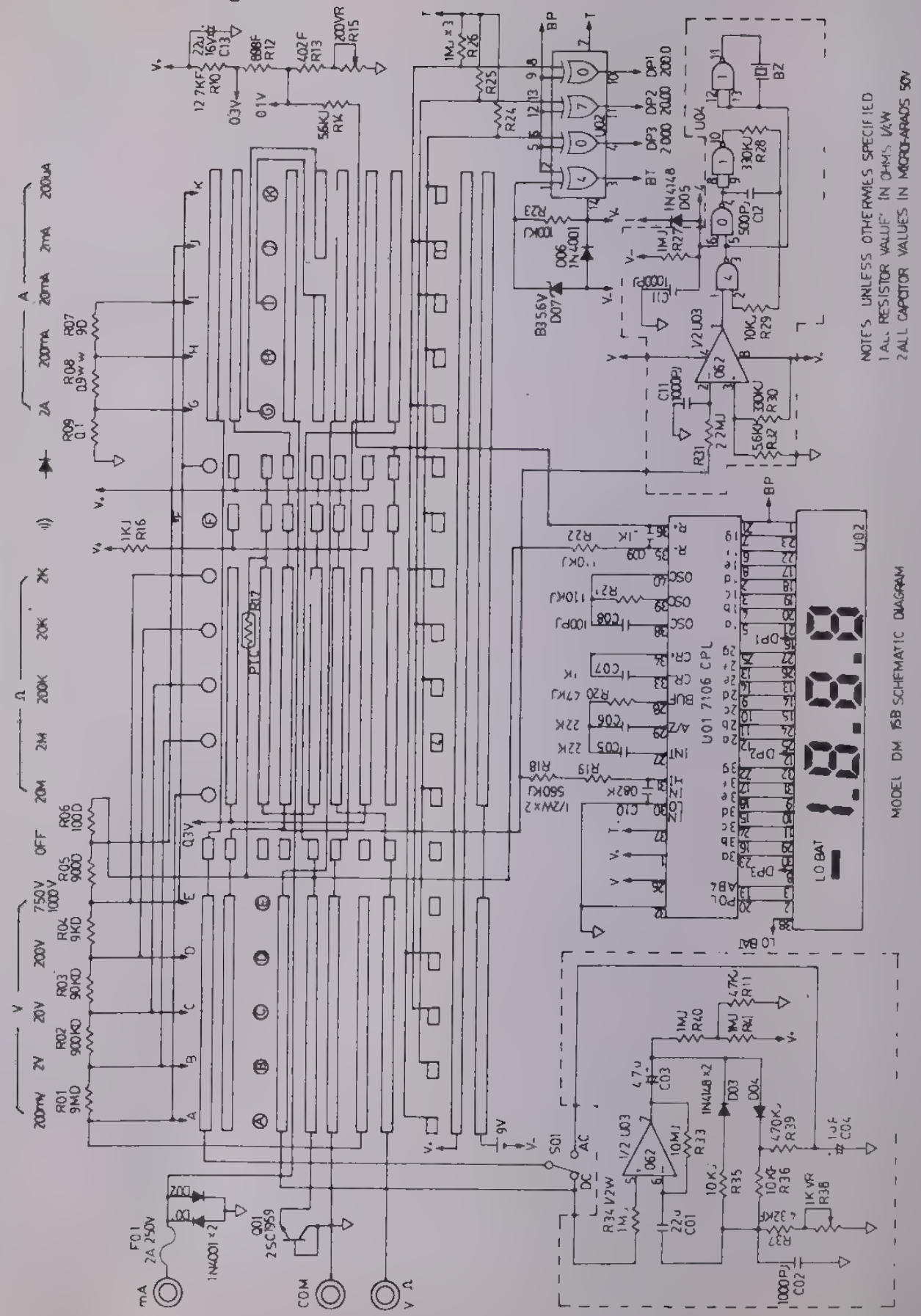
Accuracy	DM10	DM15B	DM20L
200 Ohm Range		±1.2% RDG + 4 digits	
20Meg Ohm Range		±3.0% RDG + 4 digits	
200 and 2000Meg Ohm Ranges		±5% (RDG −10 digits) + 10 digits	
Other Ranges		±1.2% RDG + 2 digits	
OL Protection		500 VAC/VDC all ranges	
Test Voltage			
200 ohm, 200Meg, 2000Meg Ranges	3.2 max	3.2 max	3.2 max
Other Ranges	0.3 max	0.3 max	0.3 max
Diode Test			
Test Current	1.0 ±0.6mA	1.0 ±0.6mA	1.0 ±0.6mA
Test Voltage	3.2 max	3.2 max	3.2 max
Continuity Beeper (DM15B and DM20L only)			
Threshold		<80 ohms	<80 ohms
Response Time		<100mS	<100mS
hFE Test (DM20L only)			
Emitter-Base Current			13 ±1mA
Emitter-Collector Current			75mA
Emitter-Collector Voltage (Open Circuit)			2.8 ±0.4 volts
Range			0 to 1000
Logic Test (DM20L only)			
Logic Type			TTL
Input Impedance			120KΩ ±10KΩ
Logic Thresholds			
Logic 1			2.4 ±0.2 volts
Logic 0			0.7 ±0.2 volts
Frequency Response			20MHz
Pulse Width Detectable			25nS minimum
OL Protection			500VAC/VDC



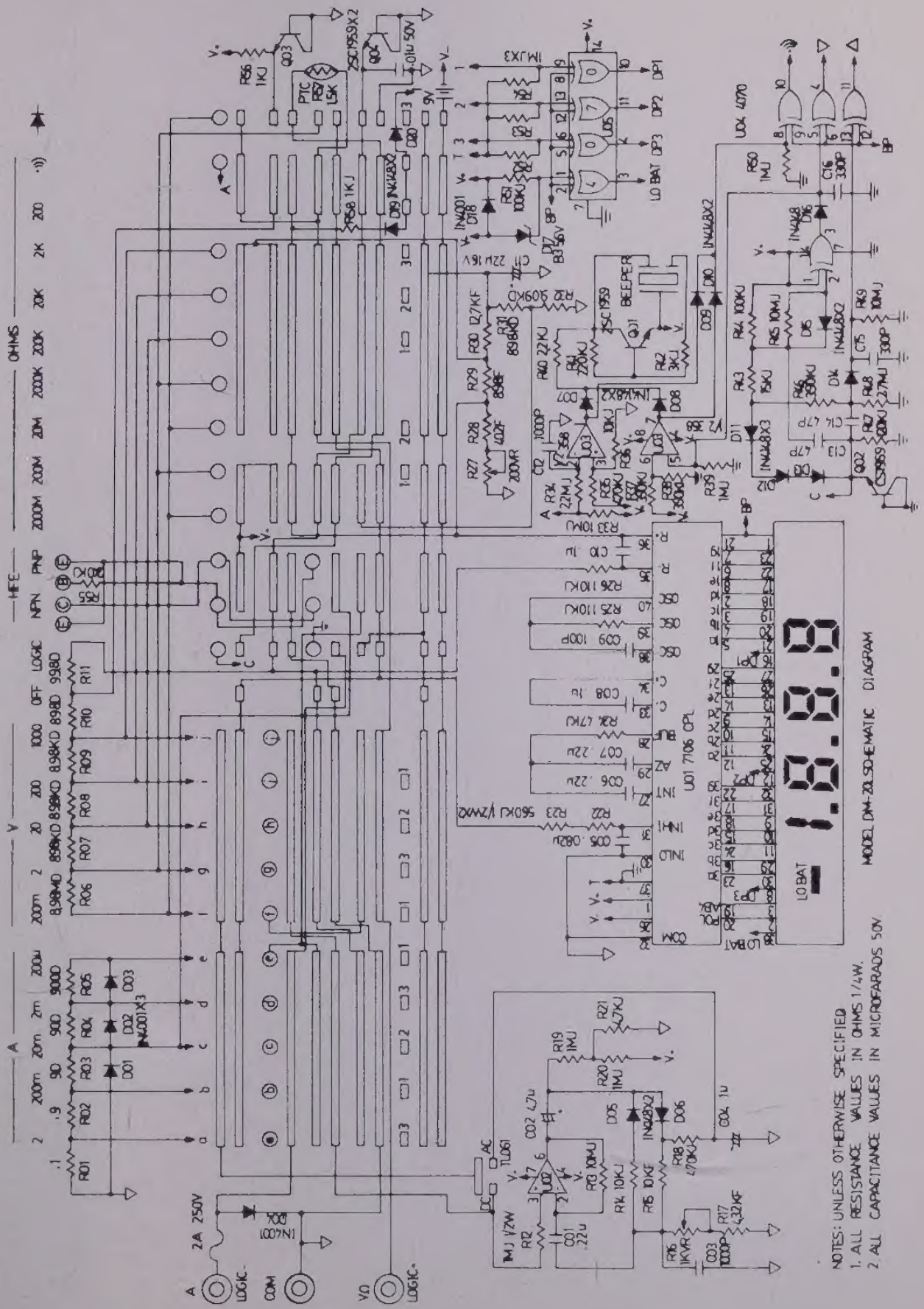
NOTES
UNLESS OTHERWISE SPECIFIED
1.ALL RESISTANCE VALUES IN OHMS 1/4W
2.ALL CAPACITANCE VALUES IN MICROFARADS 50V

MODEL DM10 SCHEMATIC DIAGRAM

DM15B Schematic Diagram


NOTES UNLESS OTHERWISES SPECIFIED
1 ALL RESISTOR VALUES IN OHMS 1/4W
2 ALL CAPACITOR VALUES IN MICRO-FARADS 50V
MODEL DM 15B SCHEMATIC DIAGRAM
U01 7106 CPL
LO BAT

M20L Schematic Diagram


MODEL DM-20L SCHEMATIC DIAGRAM
NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTANCE VALUES IN OHMS 1/4W.
2. ALL CAPACITANCE VALUES IN MICROFARADS 50V

Notes

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